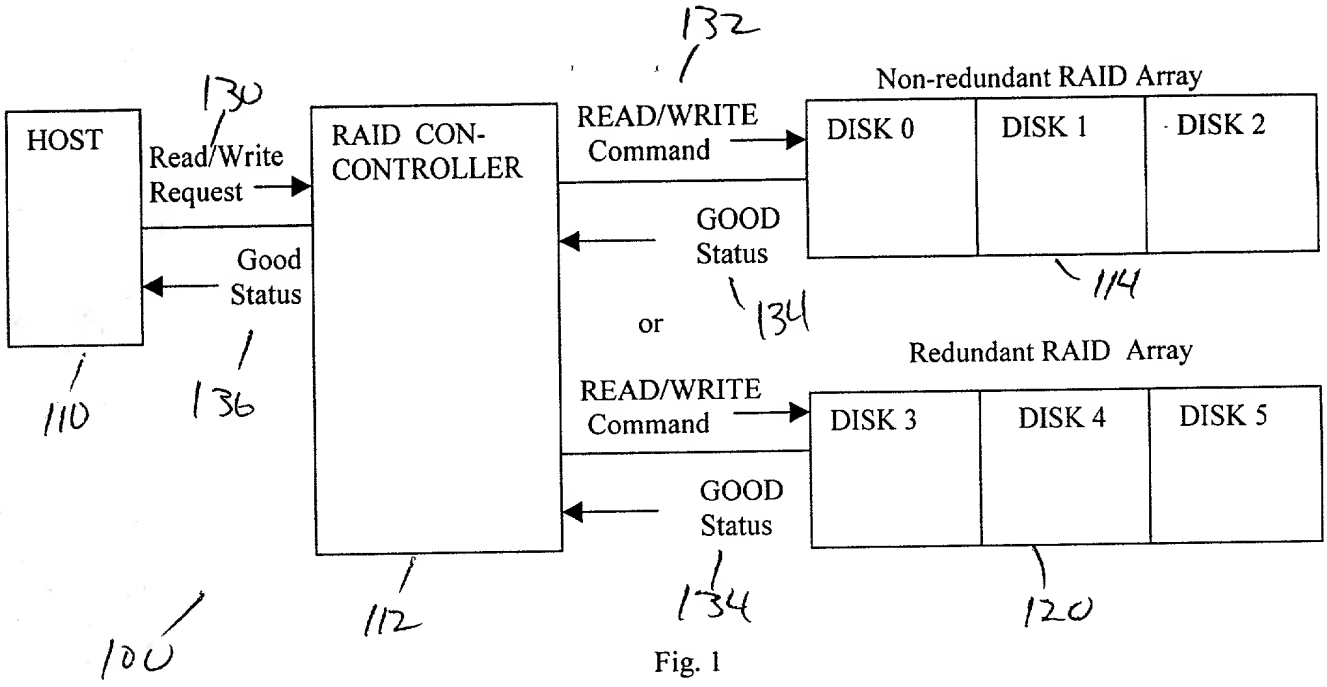

Fig. 1

Patent Pending

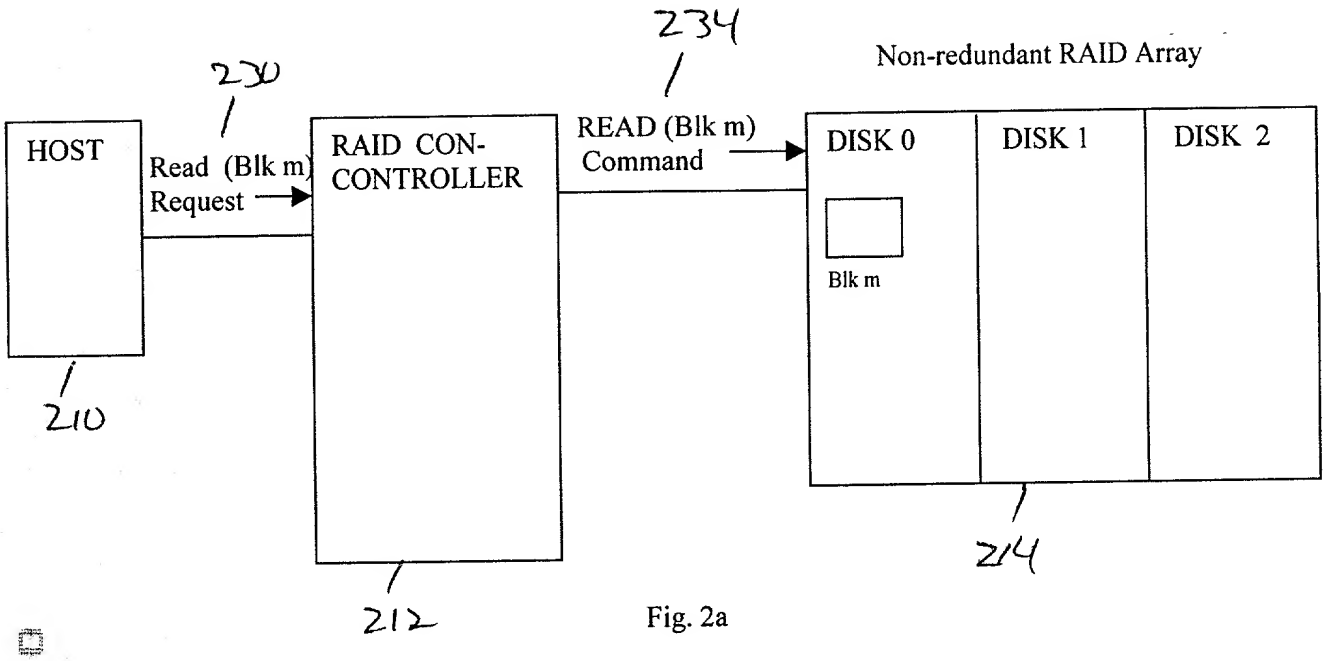
234
230
Non-redundant RAID Array
HOST
Read (Blk m) Request
RAID CON-CONTROLLER
READ (Blk m) Command
DISK 0
DISK 1
DISK 2
Blk m
210
212
214

Fig. 2a

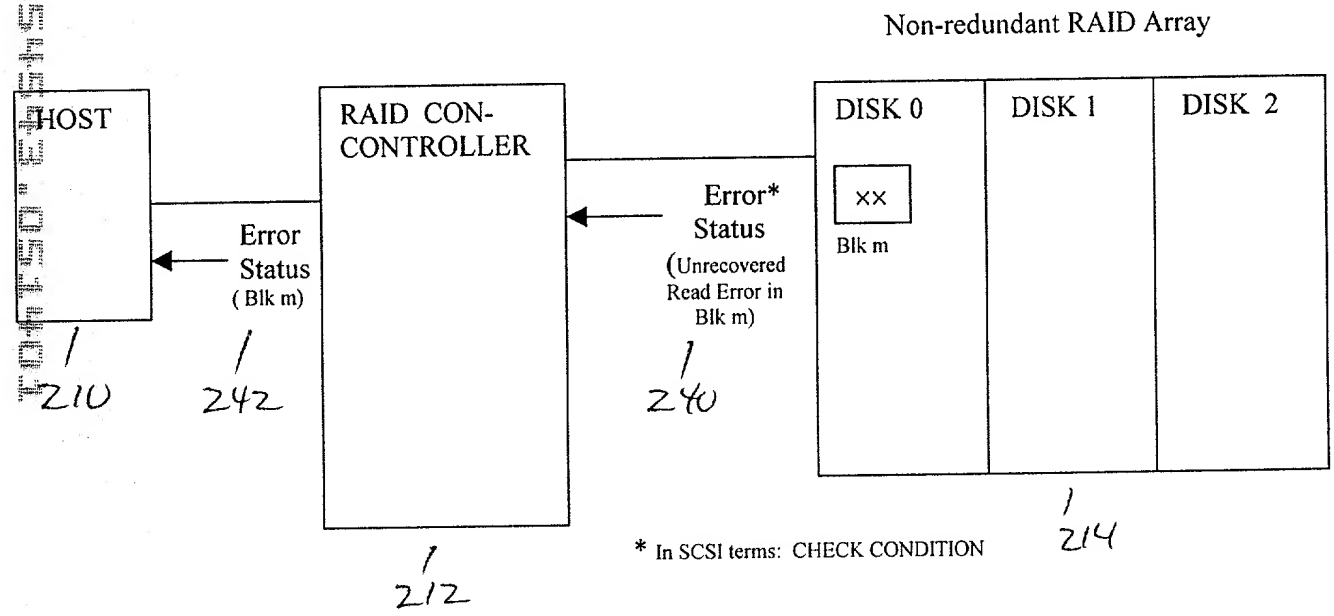
Non-redundant RAID Array
HOST
RAID CON-CONTROLLER
DISK 0
DISK 1
DISK 2
Error Status (Blk m)
Error* Status (Unrecovered Read Error in Blk m)
××
Blk m
210
242
240
212
214
* In SCSI terms: CHECK CONDITION

Fig. 2b

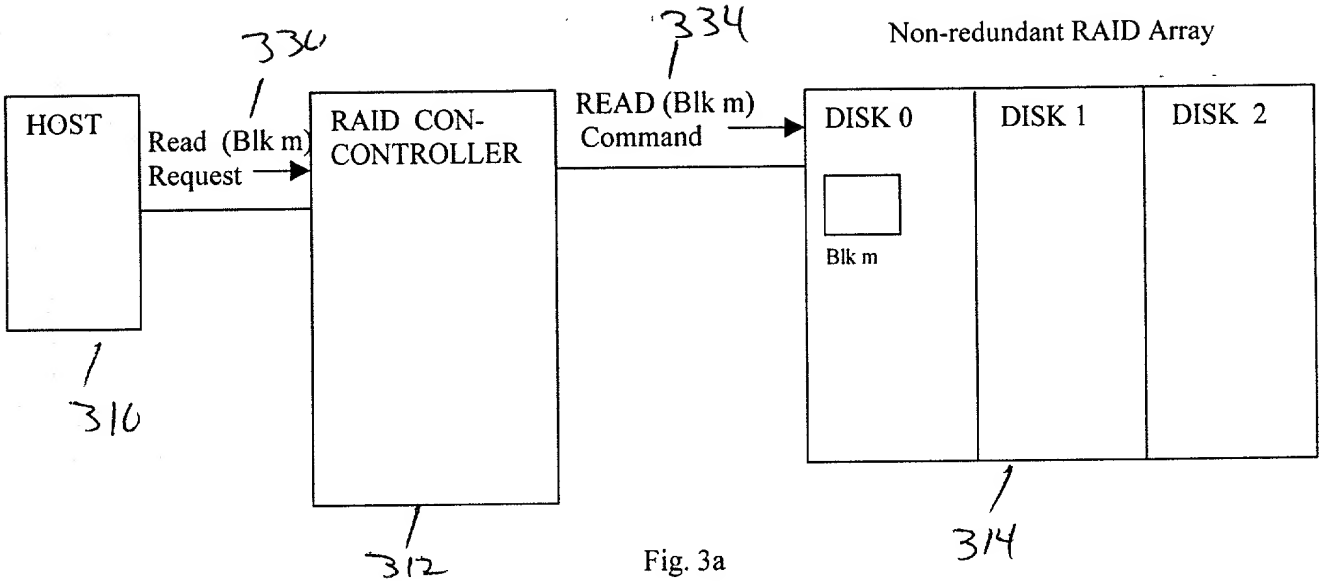
336
334
Non-redundant RAID Array
HOST
Read (Blk m) Request
RAID CON-CONTROLLER
READ (Blk m) Command
DISK 0
DISK 1
DISK 2
Blk m
310
312
314

Fig. 3a

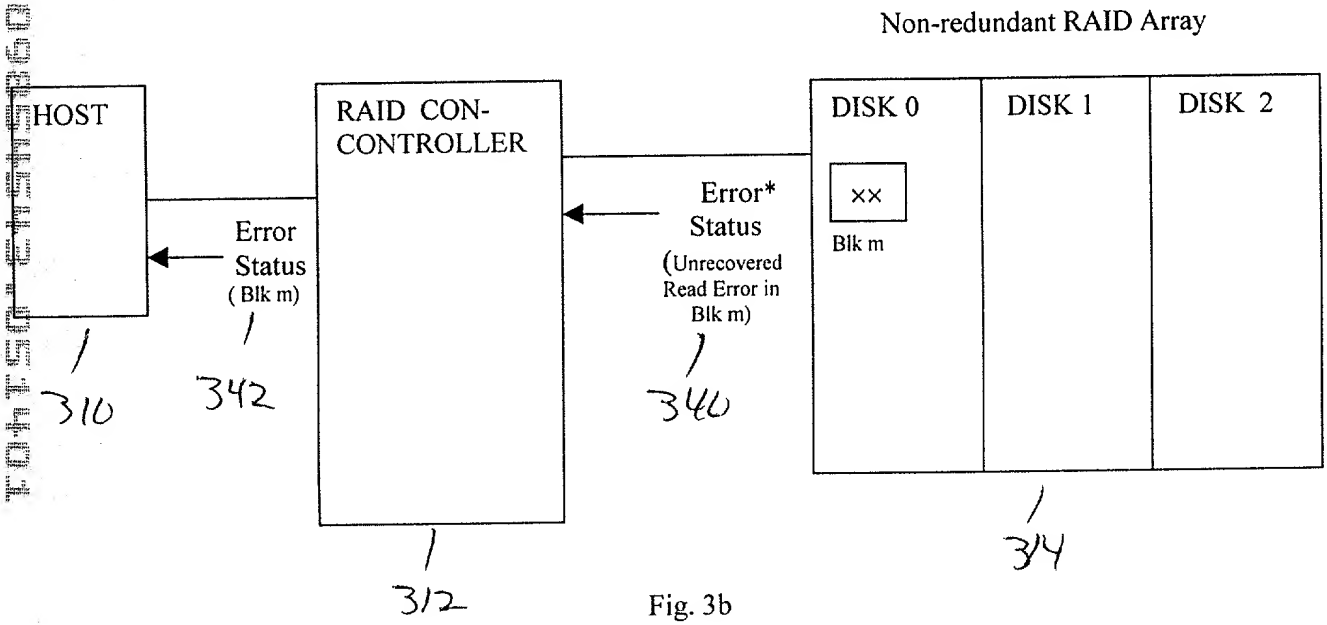
Non-redundant RAID Array
HOST
RAID CON-CONTROLLER
DISK 0
DISK 1
DISK 2
Error Status (Blk m)
Error* Status (Unrecovered Read Error in Blk m)
xx
Blk m
310
342
340
312
314

Fig. 3b

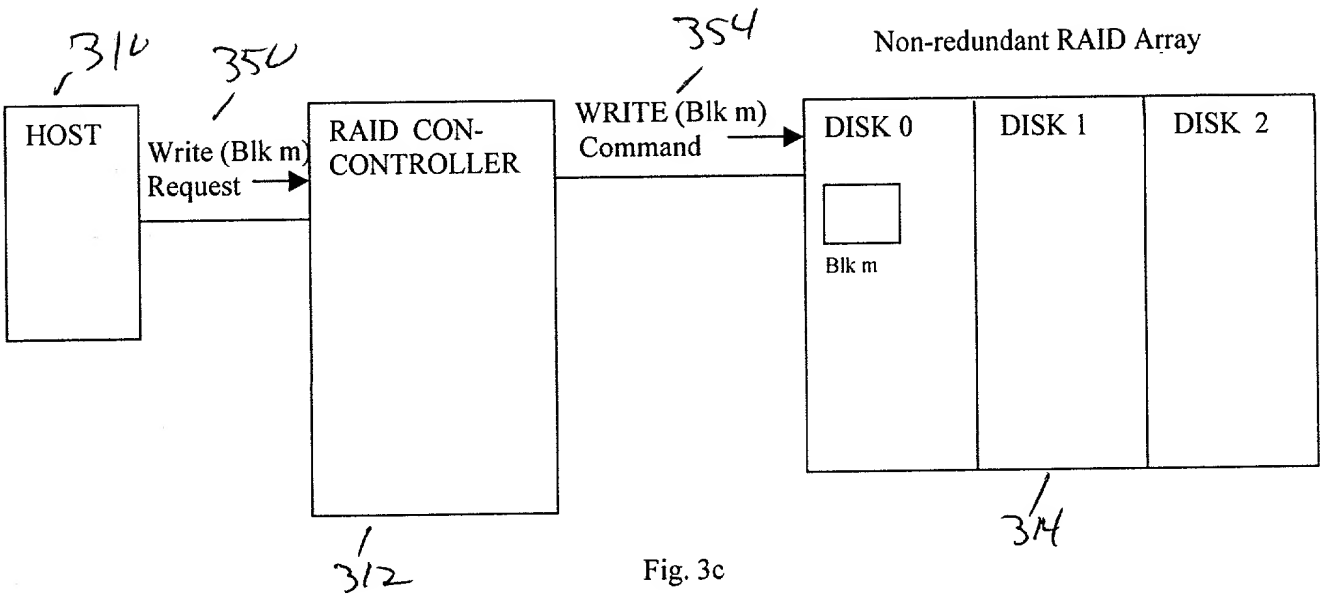
310
350
354
Non-redundant RAID Array
HOST
Write (Blk m) Request
RAID CON-CONTROLLER
WRITE (Blk m) Command
DISK 0
DISK 1
DISK 2
Blk m
312
314

Fig. 3c

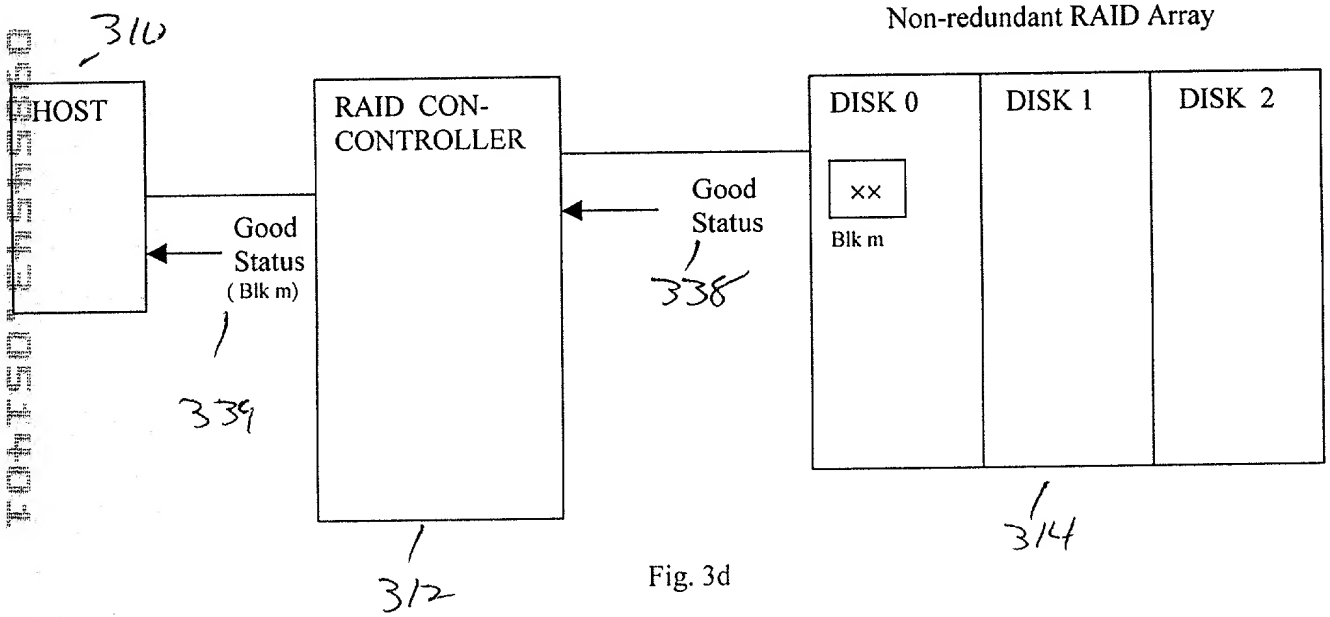
310
Non-redundant RAID Array
HOST
RAID CON-CONTROLLER
DISK 0
DISK 1
DISK 2
Good Status
Good Status (Blk m)
xx
Blk m
338
339
312
314

Fig. 3d

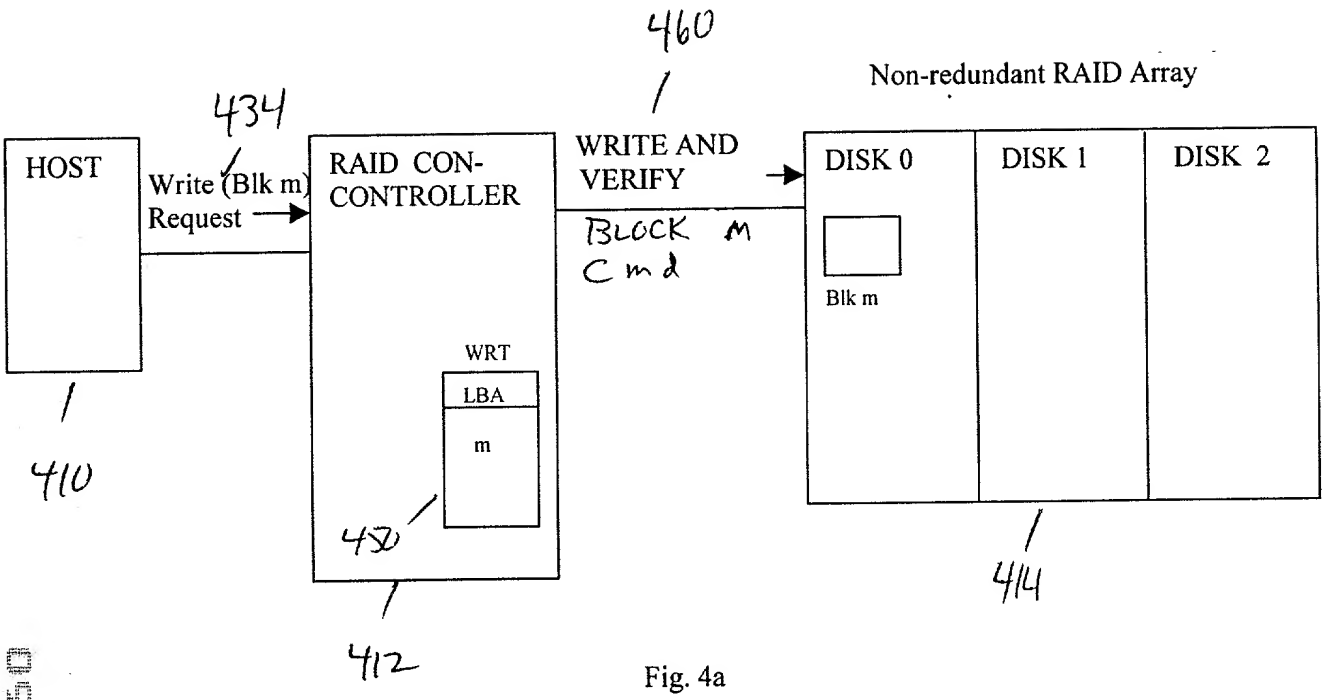
460
Non-redundant RAID Array
434
HOST
Write (Blk m)
Request
RAID CON-
CONTROLLER
WRITE AND
VERIFY
BLOCK m
Cmd
DISK 0
DISK 1
DISK 2
Blk m
WRT
LBA
m
410
450
412
414

Fig. 4a

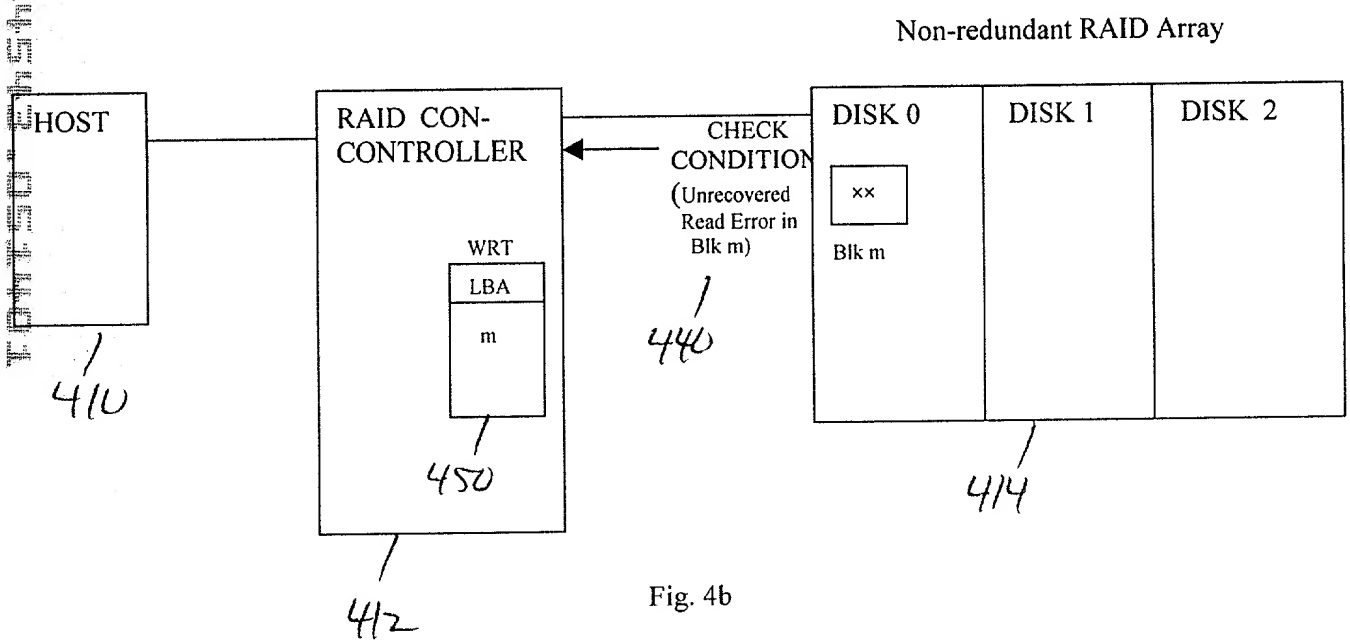
Non-redundant RAID Array
HOST
RAID CON-
CONTROLLER
CHECK
CONDITION
(Unrecovered
Read Error in
Blk m)
DISK 0
DISK 1
DISK 2
××
Blk m
WRT
LBA
m
410
440
450
412
414

Fig. 4b

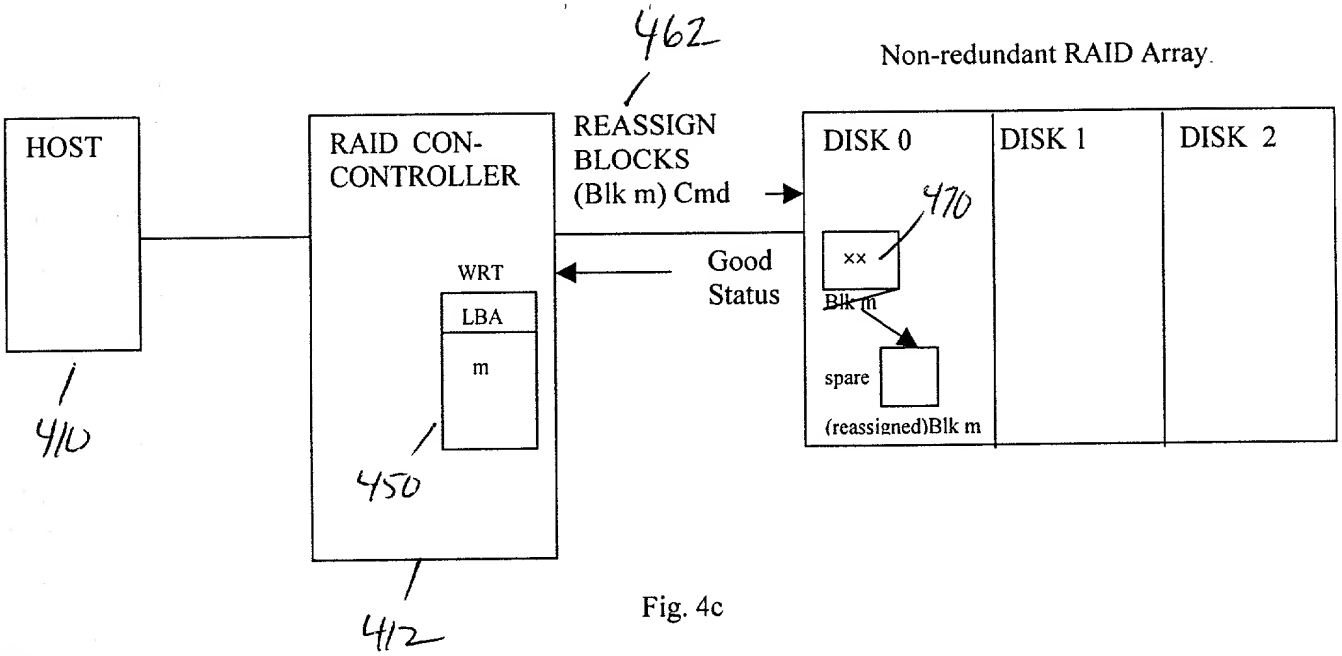
462
Non-redundant RAID Array
HOST
RAID CON-
CONTROLLER
REASSIGN
BLOCKS
(Blk m) Cmd
Good
Status
WRT
LBA
m
DISK 0
DISK 1
DISK 2
470
××
Blk m
spare
(reassigned)Blk m
410
450
412

Fig. 4c

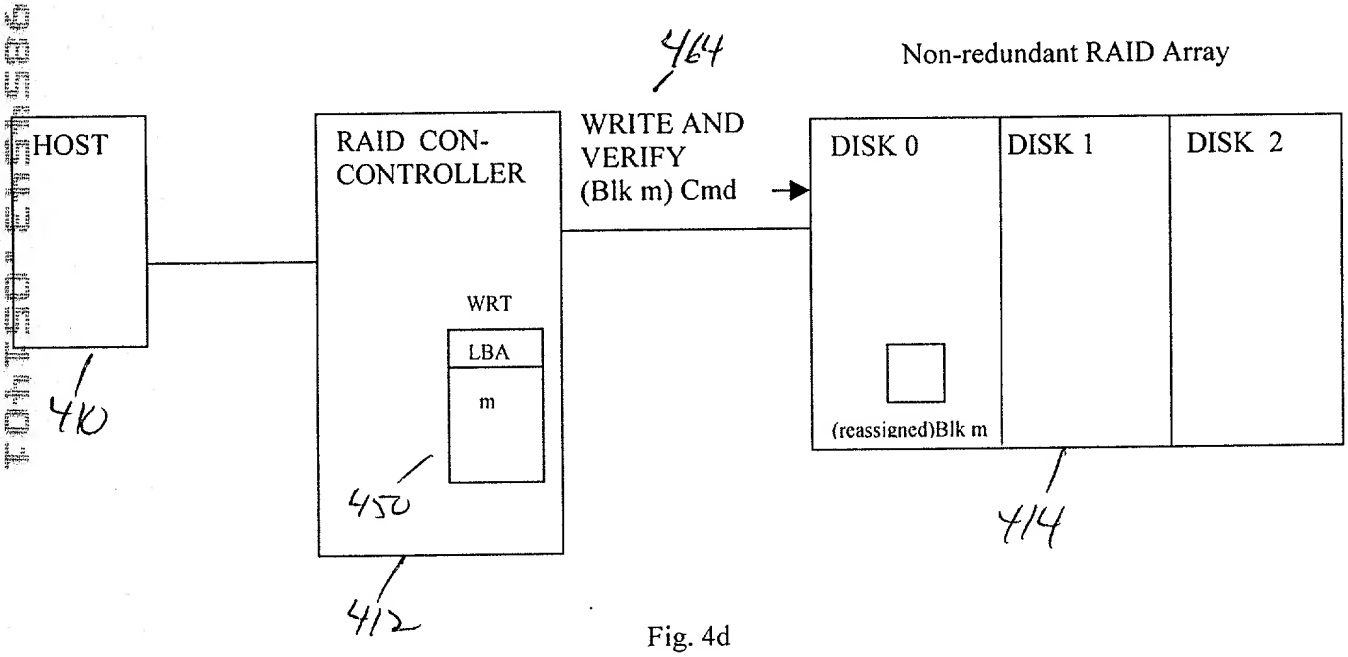
464
Non-redundant RAID Array
HOST
RAID CON-
CONTROLLER
WRITE AND
VERIFY
(Blk m) Cmd
WRT
LBA
m
DISK 0
DISK 1
DISK 2
(reassigned)Blk m
410
450
412
414

Fig. 4d

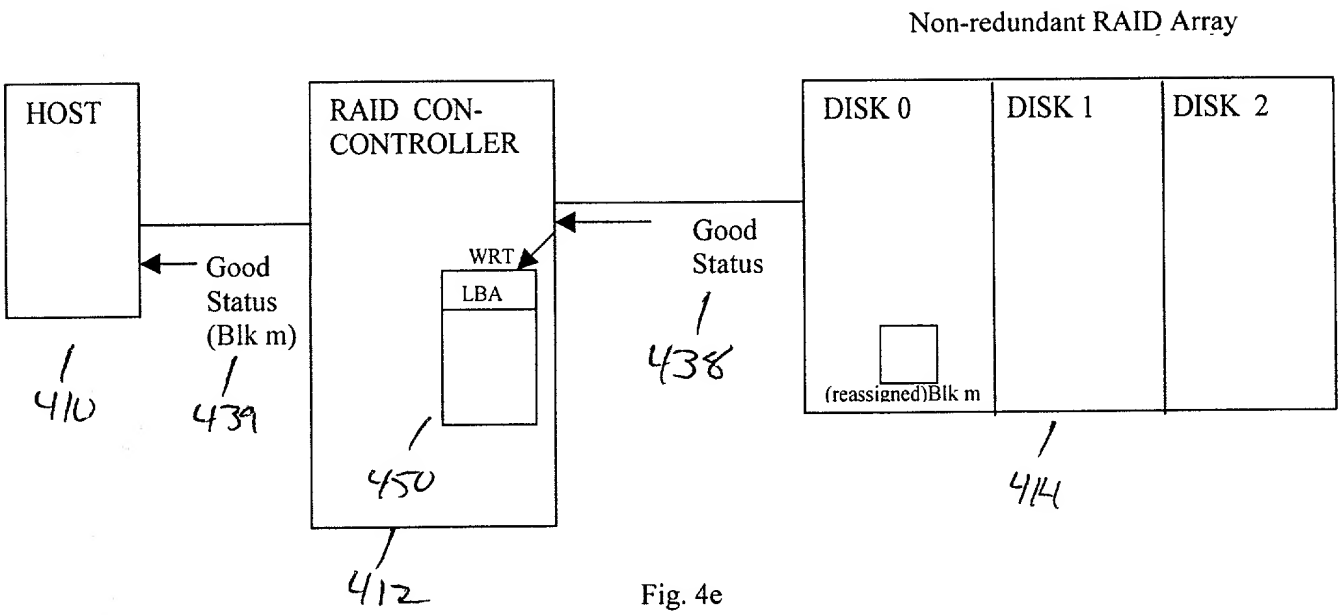
Non-redundant RAID Array
HOST
RAID CON-
CONTROLLER
DISK 0
DISK 1
DISK 2
Good
Status
(Blk m)
WRT
LBA
Good
Status
(reassigned)Blk m
410
439
450
438
412
414

Fig. 4e

500

516 520

LBA (hex)	Write Recovery bit	Explanation
00 00 A2 C0	1	Had a read error, req'ing write recovery on write, cleared after
01 24 60 3B	0	Known bad data, read error status to host; cleared on write
FF FF FF FF	0	Not a valid entry

Fig. 5

Exhibit 2 to Stipulation

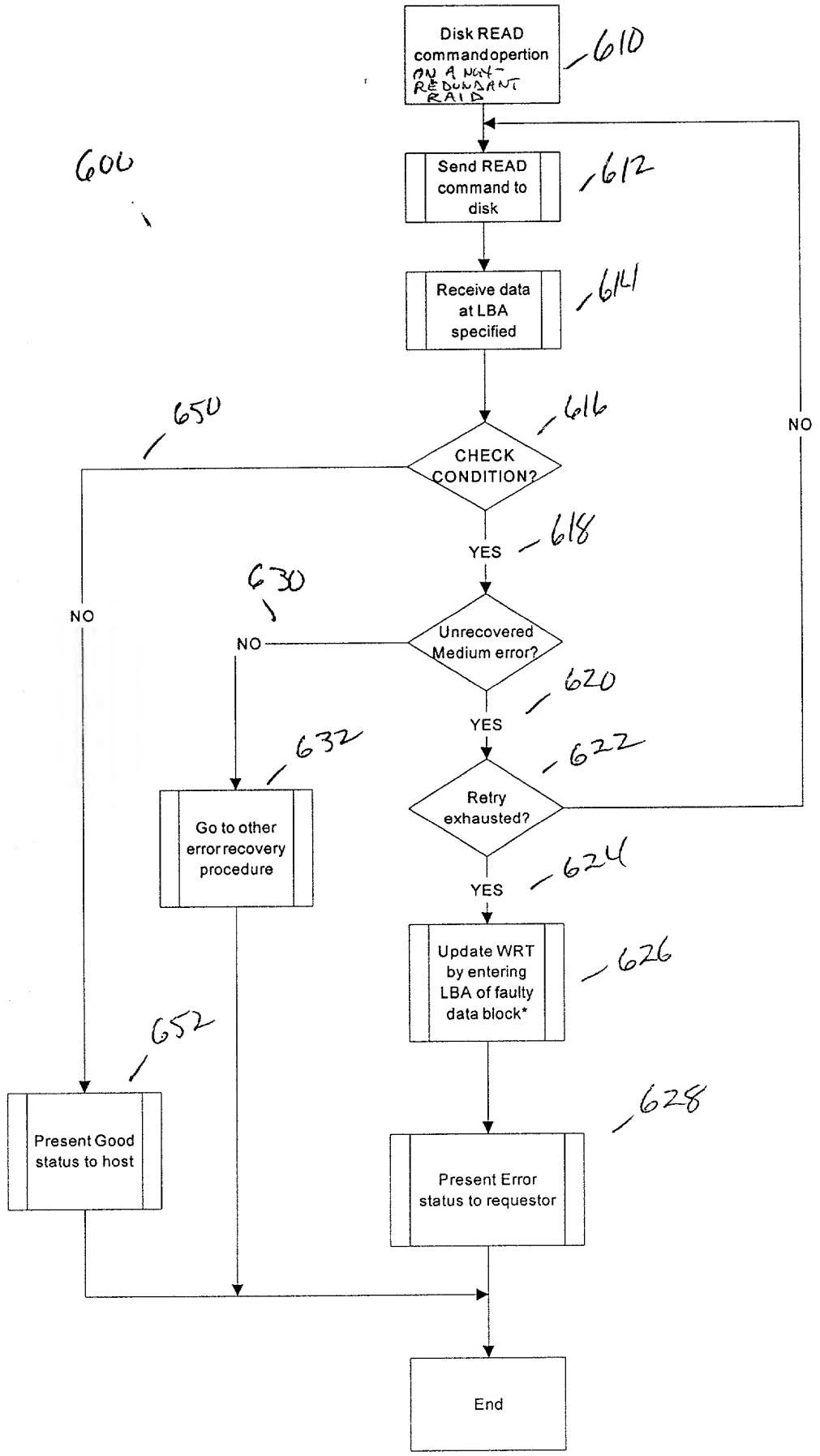
600
Disk READ command opertion ON A NON-REDUNDANT RAID
610
Send READ command to disk
612
Receive data at LBA specified
614
CHECK CONDITION?
616
650
NO
YES
618
Unrecovered Medium error?
630
NO
YES
620
Retry exhausted?
622
NO
YES
624
Go to other error recovery procedure
632
Update WRT by entering LBA of faulty data block*
626
Present Good status to host
652
Present Error status to requestor
628
End

Fig. 6

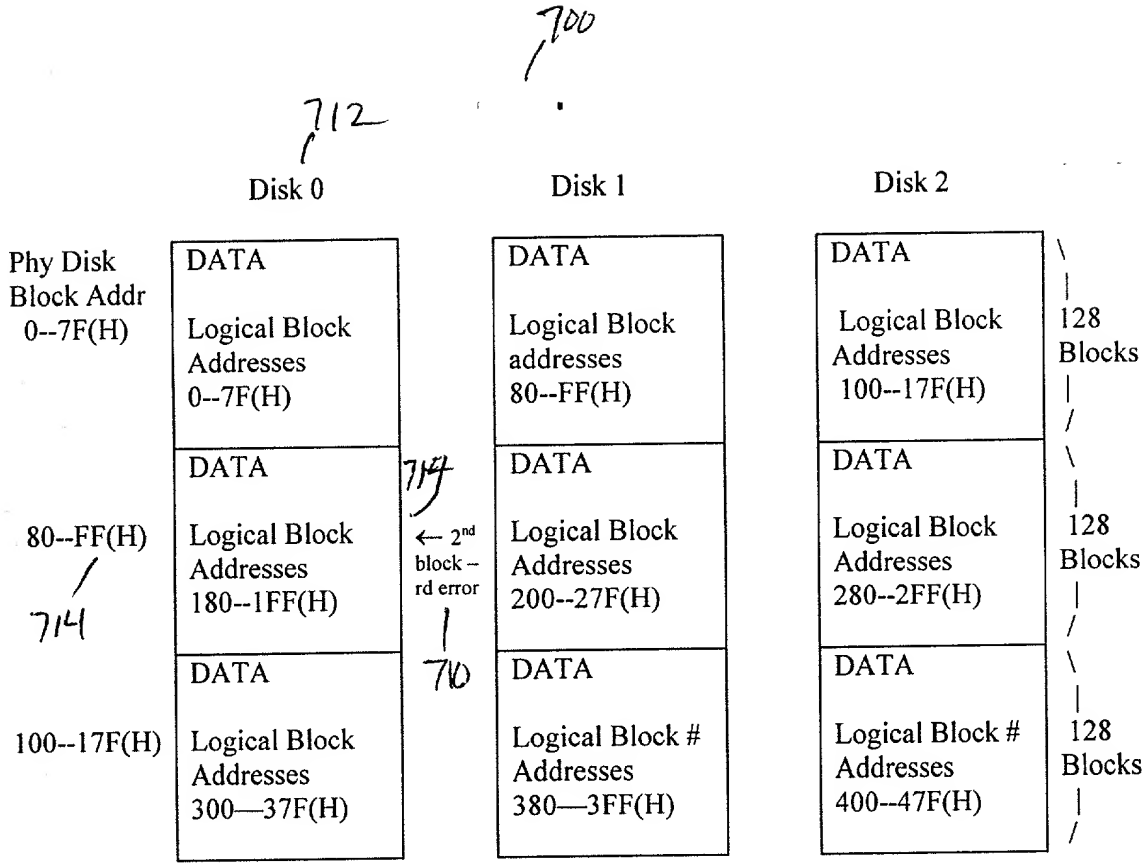

Fig. 7

0960450 *05450

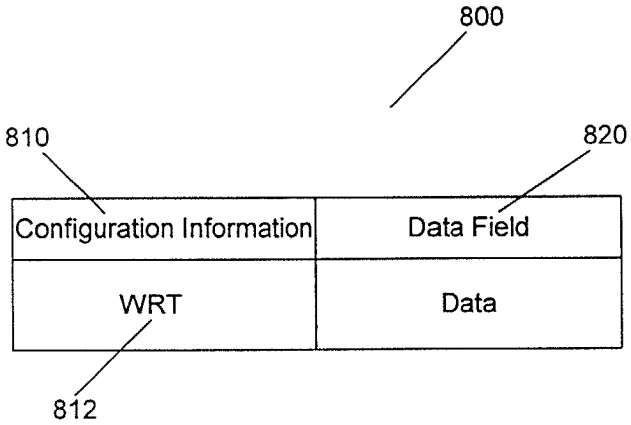
800
810
820
Configuration Information
Data Field
WRT
Data
812

Fig. 8

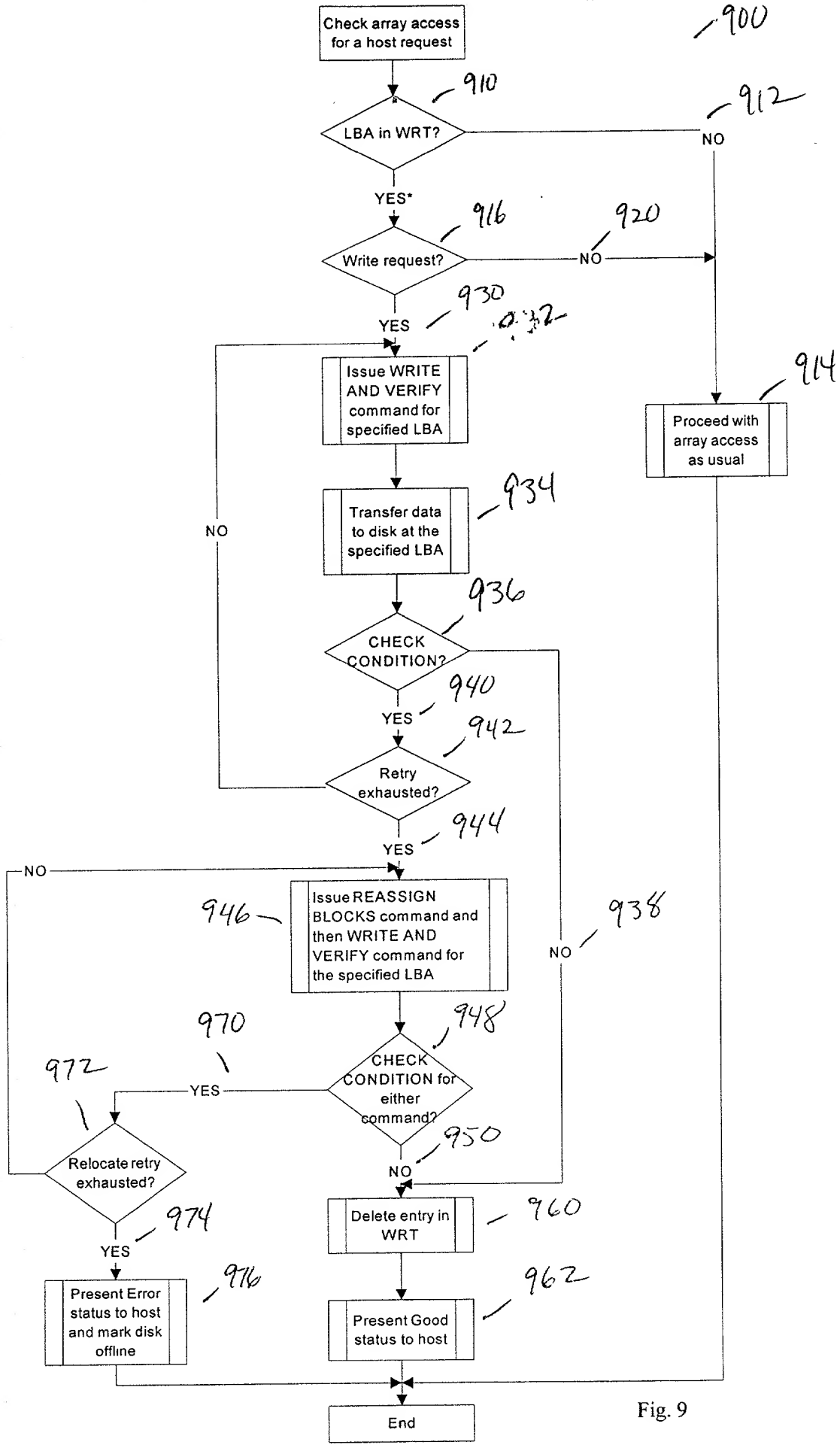
Check array access for a host request
900
910
LBA in WRT?
912
NO
YES*
916
Write request?
920
NO
YES
930
932
Issue WRITE AND VERIFY command for specified LBA
914
Proceed with array access as usual
934
Transfer data to disk at the specified LBA
NO
936
CHECK CONDITION?
940
YES
942
Retry exhausted?
944
YES
NO
946
Issue REASSIGN BLOCKS command and then WRITE AND VERIFY command for the specified LBA
938
NO
970
948
CHECK CONDITION for either command?
YES
972
Relocate retry exhausted?
950
NO
974
YES
Delete entry in WRT
960
976
Present Error status to host and mark disk offline
962
Present Good status to host
End

Fig. 9

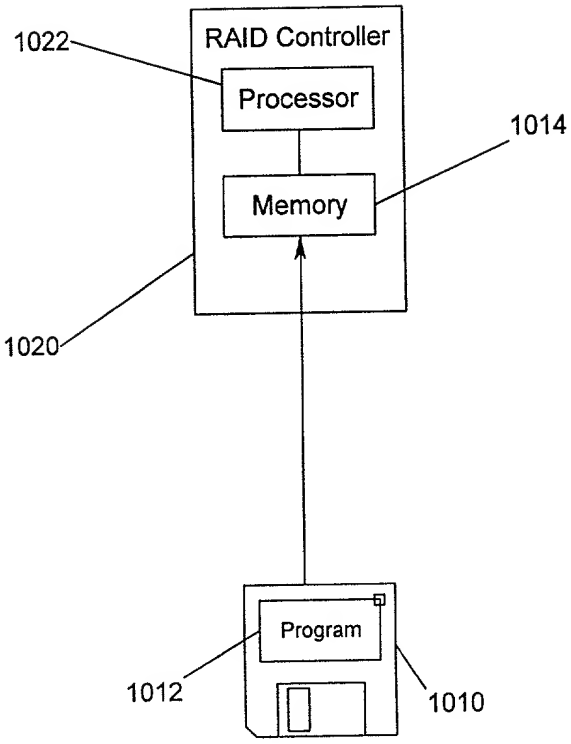
RAID Controller
Processor
Memory
1022
1014
1020
Program
1012
1010

Fig. 10